WHAT IS CLAIMED IS:

1. A semiconductor structure comprising: a substrate and a Sn_xGe_{1-x} layer formed over the substrate, wherein x has a value from about 0.02 to about 0.20.

2. The semiconductor structure of claim 1 wherein the Sn_xGe_{1-x} layer is an epitaxial layer with a direct band gap between about 0.72eV and about .041eV.

3. The semiconductor structure of claim 1, wherein x has a value of about 0.20 and the Sn_xGe_{1-x} layer is a direct-gap material.

4. The semiconductor structure of claim 1, wherein the substrate comprises a silicon substrate.

5. The semiconductor structure of claim 4 wherein the substrate comprises Si(100).

6. The semiconductor structure of claim 4 wherein the substrate comprises Si(111).

7. The semiconductor structure of claim 1, wherein the substrate comprises a silicon substrate and the $Sn_{1-x}Ge_x$ layer is formed directly on the substrate.

8. The semiconductor structure of claim 7 wherein the substrate comprises Si(100).

9. The semiconductor structure of claim 7 wherein the substrate comprises Si(111).

10. The semiconductor structure of claim 1 wherein the Sn_xGe_{1-x} layer has a thickness from about 50nm to about 1000nm.

11. The semiconductor structure of claim 1 further comprising a strained Ge layer formed over the Sn_xGe_{1-x} layer.

12. The semiconductor structure of claim 11 wherein x is greater than about 0.11 and the strained Ge layer is a direct-gap material.

13. A semiconductor structure comprising: a Ge–Sn quantum structure formed over a silicon substrate.

14. The semiconductor structure of claim 13 wherein the Ge-Sn quantum structure comprises $Ge_{1-x}Sn_x$ and x has a value from about 0.02 to about 0.03.

15. The semiconductor structure of claim 13 wherein the Ge-Sn quantum structure is formed over Ge-Sn epitaxial layer formed over the silicon substrate.

16. The semiconductor structure of claim 13 wherein the substrate comprises Si(100).

17. A method for depositing an epitaxial Ge-Sn layer on a substrate in a chemical vapor deposition reaction chamber, the method comprising introducing into the chamber a gaseous precursor comprising SnD_4 under conditions whereby the epitaxial Ge-Sn layer is formed on the substrate.

18. The method of claim 17 wherein the gaseous precursor comprises SnD_4 and high purity H_2.

19. The method of claim 17 wherein the gaseous precursor comprises high purity H_2 of about 15-20% by volume.

20. The method of claim 17 wherein the gaseous precursor is introduced at a temperature in a range of about 250°C to about 350°C.

21. The method of claim 17 wherein the substrate comprises silicon.

22. The method of claim 21 wherein the silicon comprises Si(100).

23. The method of claim 17 wherein the Ge-Sn layer comprises Sn_xGe_{1-x} and x is in a range from about .02 to about .20.

24. A method for depositing a strained Ge layer on a silicon substrate with a Ge-Sn buffer layer in a chemical vapor deposition reaction chamber, the method comprising introducing into the chamber a combination comprising SnD_4 and Ge_2H_6 under conditions whereby the Ge-Sn layer is formed on the substrate and dehydrogenating Ge_2H_6 under conditions whereby the Ge layer is formed on the Ge-Sn buffer layer.